

CLAIMS

- 1 1. A radiator element comprising:
 - 2 a pair of fin-shaped substrates spaced apart from one another, each having a
 - 3 transition section and a feed surface;
 - 4 a balanced symmetrical feed having a pair of radio frequency (RF) feed lines
 - 5 disposed adjacent to and electromagnetically coupled to a corresponding one of the feed
 - 6 surfaces; and
 - 7 wherein the pair of radio frequency feed lines forms a signal null point adjacent the
 - 8 transition sections.

- 1 2. The radiator element of Claim 1 wherein:
 - 2 the balanced symmetrical feed further comprises a housing having a plurality of
 - 3 sidewalls forming a cavity; and
 - 4 the pair of feed lines are each disposed on a corresponding one of the sidewalls and
 - 5 comprise a microstrip transmission line.

- 1 3. The radiator element of Claim 1 wherein the pair of fin-shaped substrates are
- 2 disposed to form a tapered slot.

- 1 4. The radiator element of Claim 1 wherein the balanced symmetrical feed is a raised
- 2 balanced symmetrical feed.

- 1 5. The radiator element of Claim 1 wherein a first one of the pair of radio frequency
- 2 feed lines is adapted for receiving a radio frequency signal and a second of one the pair of
- 3 radio frequency feed lines is adapted for receiving a radio frequency signal phase shifted
- 4 by approximately 180 degrees.

- 1 6. The radiator element of Claim 1 wherein the pair of substrates are provided from
- 2 an electrically conductive material.

1 7. The radiator element of Claim 6 wherein the pair of substrates comprise copper
2 plated metal.

1 8. The radiator element of Claim 1 wherein the pair of substrates comprise a
2 metalized substrate.

1 9. The radiator element of Claim 1 wherein each of the substrates has a height of less
2 than approximately $0.25\lambda_L$, where λ_L refers to the wavelength of the low end of a range
3 of operating wavelengths.

1 10. The radiator element of Claim 1 further comprising:
2 a second pair of substrates spaced apart from one another each having a transition
3 section forming a second tapered slot and having a second feed surface wherein the
4 second pair of substrates form a plane which is substantially orthogonal to a plane formed
5 by the first pair of substrates;
6 wherein the balanced symmetrical feed includes a second pair of radio frequency
7 feed lines each disposed adjacent to and electromagnetically coupled to the feed surface of
8 one of the second pair of transitions; and
9 wherein the second pair of radio frequency feed lines are electromagnetically
10 coupled to the second feed surfaces adjacent the signal null point.

1 11. The radiator element of Claim 1 wherein each of the feed surfaces has a first
2 portion in a first plane and a second portion in a second plane, wherein the first plane
3 forms an angle of from about 91 degrees to about 180 with the second plane.

1 12. The radiator element of Claim 1 wherein the balanced symmetrical feed further
2 comprises:
3 a cavity having a plurality of sidewall surfaces and a top surface disposed adjacent
4 the pair of radio frequency feed lines; and
5 a pair of transmission feed lines, each disposed adjacent to an opposing

6 corresponding sidewall surface of said cavity and having a first feed end
7 electromagnetically coupled to a corresponding one of the pair of radio frequency feed
8 lines.

1 13. The radiator element of Claim 12 wherein each of the pair of transmission feed
2 lines further comprise a second feed end; and

3 the radiator element further comprises a balun having a pair of outputs each
4 coupled to a corresponding one of the second feed ends of the pair of transmission feed
5 lines.

1 14. The radiator element of Claim 13 further comprising a pair of amplifiers each
2 coupled between a corresponding balun output and second feed end of one of the pair of
3 transmission feed lines.

1 15. A wideband antenna comprising:

2 a cavity plate having a first surface and a second opposing surface;

3 a first plurality of fins disposed on the first surface of the cavity plate spaced apart
4 from one another forming a first plurality of tapered slots having a feed surface;

5 a second plurality of fins disposed on the first surface of the cavity plate spaced
6 apart from one another forming a second plurality of tapered slots, each substantially
7 orthogonal to a corresponding one of the first plurality of tapered slots and having a feed
8 surface; and

9 a plurality of balanced symmetrical feed circuits disposed on the first surface, each
10 having a pair of radio frequency (RF) feed lines electromagnetically coupled to
11 corresponding ones of the feed surfaces.

1 16. The wideband antenna of Claim 15 wherein the cavity plate further comprises a
2 plurality of apertures; and

3 wherein each of the plurality of balanced symmetrical feed circuits is disposed in a
4 corresponding one of the plurality of apertures.

1 17. The wideband antenna of Claim 17 further comprising a connector plate disposed
2 adjacent the second surface of the cavity plate and having a plurality of connections;
3 and wherein each of the plurality of balanced symmetrical feed circuits has a
4 plurality of feed connections each coupled to a corresponding one of the plurality of
5 connector plate connections.

1 18. The antenna of Claim 15 wherein each of the fins has a height of less than about
2 approximately $0.25\lambda_L$, where λ_L refers to the wavelength of the low end of a range of
3 operating wavelengths.

1 19. The antenna of Claim 15 wherein each of the plurality of balanced symmetrical
2 feed circuits is a raised feed circuit having a shape which conforms to the feed surfaces of
3 a corresponding one of the plurality of fins.

1 20. The antenna of Claim 15 further comprising a plurality of baluns each coupled to a
2 corresponding RF feed line.

1 21. The antenna of Claim 20 further comprising a plurality of RF connectors each
2 coupled to a corresponding one of the plurality of baluns.

1 22. A method for converting the propagation mode of a waveform from a TEM mode
2 to a Floquet mode in a notched radiator element, the method comprising:
3 providing a pair of elements;
4 providing a balanced symmetrical feed circuit having a pair of radio frequency feed
5 lines;
6 coupling the pair of radio frequency feed lines to the elements;
7 feeding the elements with a differential RF signal coupled to each of the pair of
8 radio frequency feed lines.

1 23. The method of Claim 22 wherein each of the pair of elements comprises a pair of

2 substrates each having a transition section and a feed surface and wherein the transition
3 sections form a tapered notch.

1 24. The method of Claim 23 wherein each of the substrates has a height of less than
2 approximately $0.25\lambda_L$, where λ_L corresponds to the wavelength of the low end of a range
3 of operating wavelengths.